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February 2, 2015

Mayor and City Council Members
City of Hayward
777 B Street
Hayward, CA 94541

Madam Mayor and Council Members,

We are the developer of the South Hayward Bart Market rate project located at 28550 Dixon Street. Eden Housing, Inc. is the developer of the affordable project adjacent to our project along Mission Boulevard.

On December 18, 2014, AMCAL Hayward LLC and Eden Housing, Inc. formally requested the City allow the use of the alternate plastic materials on our respective projects. Accordingly, we agree with the Staff Report dated February 5, 2015 to align Hayward's local plumbing code with the 2013 State Plumbing Code. In addition, we provided City staff with a copy of our Geotechnical Report that highlights the "highly corrosive" nature of the soil on our sites. The use of the alternate material will mitigate the risk of failure in the underground piping. Attached please find the Report for your reference.

The adoption of the ordinance will greatly enhance the useful life of the underground infrastructure as well as the building components it serves in these two developments.

We urge you to adopt the ordinance recommended by City staff as time is critical. Since Eden has begun construction and we will follow this month, a timely decision is needed to allow us to use the more appropriate material which will produce a better, longer lasting development.

Best regards,

Percival Vaz
AMCAL Hayward LLC

Cc: Neil Saxby, Eden Housing, Inc.

AMSO CONSULTING ENGINEERS
SOILS, FOUNDATIONS & ENVIRONMENTAL ENGINEERING

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September 21, 2011
Project 3567

Ms. Andrea Osgood
Eden Housing, Inc.
22645 Grand Street
Hayward, California 94541

Subject: Geotechnical Investigation For
South Hayward Residential Development
Between Dixon Street & Mission Boulevard
Hayward, California

Dear Ms Osgood:

This report presents the results of our geotechnical investigation for the South Hayward Residential Development proposed for construction within the BART parking located along the east side of Dixon Avenue and the property located at 28901, 28937 and 28953 Mission Boulevard in Hayward, California.

PROPOSED DEVELOPMENT

We understand that the project will consist of affordable residential units for seniors, affordable residential units for families and market rate units. The affordable residential building will occupy the eastern portion of the site (along Mission Boulevard) and will consist of a basement level parking with a concrete podium and up to five stories above. The market value building will be constructed along the west portion of the site (along Dixon Street) and will have a street level parking with a concrete podium and up to four stories above.

PROVIDED INFORMATION

The project architect provided us with an electronic copy of a Site Plan that shows the location of the proposed buildings and a cross section. The site plan was used to prepare our site plan (Figure 2) that shows the location of our exploration holes that were made as part of this geotechnical investigation.

SCOPE OF WORK

We propose to perform the following scope of work for this geotechnical investigation.

1. Reviewed geologic and geotechnical information in our files pertinent to the site and the surrounding area. We also reviewed a copy of a report entitled "Geotechnical Investigation on Mission and Tennyson Project, Proposed Residential Development, 28953 Mission Boulevard, Hayward, California" prepared by Terrasearch, Inc. and dated June 23, 2004.

2. Obtained a drilling permit from the Alameda County Public Works Agency, Water Resources Well Permit. The permit number was W2011-0566 and dated August 31, 2011.

3. Explored, sampled and classified subsurface soils by means of four small diameter exploration borings. At the end of drilling all exploration holes were backfilled with cement grout under the supervision of Alameda County Public Works inspector.

4. Performed laboratory testing on soil samples to measure their pertinent index and engineering properties.

5. Reviewed and analyzed of the information collected from our literature review, subsurface exploration and laboratory test data.

6. Developed site seismic characteristics in accordance with the new California Building Code (CBC).

7. Prepared this report summarizing our findings, conclusions, and geotechnical recommendations.

FINDINGS

Surface Conditions

The project site extends between Mission Boulevard and Dixon Street about 700 to 600 feet south of their intersection with Tennyson Road in Hayward, California. The site for the proposed residential development slopes down from Mission Boulevard to Dixon Street with an estimated elevation of about 42 feet along the east to about 23 feet along the west (Based on the USGS Topographic Maps).

The property is bordered by a residential along the north, by Mission Boulevard along the east, by a vacant property and houses along the south, and by Dixon Street and BART parking on the west.

At the time of our subsurface exploration in September of 2011, the eastern (upper) portion of the project site was occupied by a commercial building and paved parking. The western (lower) portion of the project site was partially occupied by a paved parking for BART and by bare ground.

Previous Geotechnical Investigation

In June of 2004, a geotechnical investigation of the site was performed by Terrasearch, Inc. For their investigation, the other consultant drilled four exploration holes as shown on the site plan and location of exploration borings attached to this report on Figure 2.

The Terrasearch, Inc. report indicated that the site is primarily underlain by an average of about 3 feet of fill soil consisting of sandy silty clay that is underlain by clay of intermediate to high plasticity that extends to the maximum depth of their exploration with minor thin lenses of sand and silt.

The report also indicates that ground water was encountered at about 16 feet below existing ground surface within the lower portion of the site (western portion) and at about 29 feet below existing ground surface in the upper (eastern) portion of the site.

Site Geology and Subsurface Conditions

Figure 4 shows a portion of a published geologic map of the site and vicinity. This map shows the site to be underlain by **Qhaf, Alluvial Fan and Fluvial Deposits (Holocene)** and **Qpaf, Alluvial Fan and Fluvial Deposits (Pleistocene)** consisting of brown or tan, medium dense to dense, gravely sand or sandy gravel that generally grades upward, to sandy or silty clay. This was confirmed by all of our shallow exploration borings.

Subsurface conditions under the proposed buildings by means of four small diameter exploration borings. The exploration borings were drilled to between 20 feet and 40 feet below existing ground surface. Within the depths of our exploration, the native soils at the site consist of clay, silt and minor sand.

The upper (eastern) portion of the site is underlain by a layer of fill that varies in thickness between 2.5 feet 3.5 feet. This layer of fill consists of silty clay (CL) of low plasticity and moderate to low potential for expansion and contains various amounts of crushed rock. Below this layer of fill, the site is predominantly underlain by silty clay of low to high plasticity (CL/CH) and moderate to high potential for expansion that extends to about 10 feet bellow existing ground surface. Below the depth of 10 feet and to the maximum depth of our exploration, the site is underlain by clays of low to intermediate plasticity.

Ground water was first encountered in exploration B-1 at a depth of about 29 feet below existing ground surface. At the end of drilling and before the hole was filled with cement grout, the depth to the top of the ground water was measured at a depth of about 26 feet below existing ground surface. No ground water was encountered in exploration hole B-2. Within borings B-3 and B-4, ground water was measured at a depth of 14 and 12 feet below existing ground surface.

The descriptions given above pertain only to the subsurface conditions found at the site at the time of our subsurface exploration in September 0f 2011. Subsurface conditions, particularly ground water levels and the consistency of the near-surface soils, will vary with the seasons.

Detailed descriptions of the materials encountered in the borings are given on the appended boring and cone penetration test logs together with the results of some of the laboratory tests performed on selected samples obtained from the drill holes.

Seismic Considerations

This site is located within the seismically active San Francisco Bay region but outside any of the Alquist-Priolo Earthquake Fault Zones. The following faults are closest to the site.

Fault	Distance to Fault		Maximum Moment
	Miles	Kilometers	Magnitude
HAYWARD (Total Length)	0.7	1.1	7.1
CALAVERAS (No.of Calaveras	8	12	6.8
SAN ANDREAS (1906)	18	29	7.9
MONTE VISTA - SHANNON	17	28	6.8
CONCORD - GREEN VALLEY	18	29	6.9
GREENVILLE	19	31	6.9
SAN GREGORIO	26	41	7.3
HAYWARD (SE Extension)	14	23	6.4
CALAVERAS (So.of Calaveras	20	32	6.2

Seismic hazards can be divided into two general categories, hazards due to ground rupture and hazards due to ground shaking. Since no active faults are known to cross this property, the risk of earthquake-induced ground rupture occurring across the project site appears to be remote. Based on historic records and on the known general seismicity of the San Francisco Bay region, we consider it probable that during the next 50 years the site will be shaken by at least one earthquake of Richter Magnitude 6.5 or greater, and by numerous earthquakes of lesser Magnitude, all having epicentral locations within about 20 miles of the site.

Should a major earthquake occur with an epicentral location close to the site, ground shaking at the site will undoubtedly be severe, as it will for other property in the general area. Even under the influence of severe ground shaking, the mostly clayey soils that underlie this site are unlikely to liquefy.

Seismic Design Parameters

The following general site seismic parameters may be used for design in accordance with the California Building Code.

Site Class: **D** (Stiff Soil Profile)

Mapped Acceleration Parameters: $\mathbf{S_s}$ (for short periods) = 1.97g
$\mathbf{S_1}$ (for 1-second period) = 0.76g

Site Coefficient: $\mathbf{F_a}$ (for short periods) = 1.0
$\mathbf{F_v}$ (for 1-second period) = 1.5

Adjusted Maximum Considered EQ Spectral Response Acceleration Parameters:

$$\mathbf{S_{MS} = F_a * S_s} = 1.97g$$
$$\mathbf{S_{M1} = F_v * S_1} = 1.15g$$

Design Spectral Response Acceleration Parameters:

$$\mathbf{S_{DS} = 2/3 * S_{MS}} = 1.31g$$
$$\mathbf{S_{D1} = 2/3 * S_{M1}} = 0.76g$$

Seismic Design Category: **E**

We should point out that the structural seismic design is not intended to eliminate damage to a structure. The goal of the design system is to minimize the loss of human life. It is unlikely that any structure can be designed to withstand the forces of a great earthquake without any damage at all.

Potential Geologic and Geotechnical Hazards

There are several potential geologic and geotechnical hazards that can affect any given site. They are discussed below, along with any required mitigation measures.

Ground Rupture: Since no faults are believed to cross the site, it is our opinion that this is not a significant hazard to this site. No mitigation is required.

Ground Shaking: This hazard is common to all properties in California. Mitigate by proper structural design and by following the recommendations presented in this report.

Lurching and Lateral Spreading: Such seismically generated movements are induced in areas with weak soils near open cuts or slopes. Such conditions do not exist on this site. No mitigation is required.

Liquefaction: No potentially liquefiable sands were found at this site. No mitigation is required.

Landsliding: The site and vicinity are flat. Landsliding is not a potential hazard to this site. No mitigation is required.

Compressible Soils: The clayey soils that underlie the site have a low potential of compression and settlement under the influence of the building loads. The anticipated total settlement is about 1 inch and differential settlement of about half of the total settlement. The building foundations should be structurally designed to tolerate the anticipated settlement.

Expansive Soils: The clayey soils that underlie the site have low to moderate potential for expansion. To minimize the potential effect of expansion on the proposed structures, the surface layer of clay should be water conditioned and compacted as recommended in the "Site Preparation, Grading and Compaction" section of this report.

Erosion: The site soils are moderately erodable. Mitigate by controlling the discharge of concentrated water, both during and after construction.

CONCLUSIONS AND RECOMMENDATIONS

The site is suitable for the proposed construction of the housing project provided that the recommendations presented in this report are followed during the design and construction phases.

The following recommendations, which are presented as guidelines to be used by project planners and designers, have been prepared assuming **AMSO CONSULTING ENGINEERS** will be commissioned to observe and test during site grading and foundation construction. This additional opportunity to inspect the project site will allow us to compare subsurface conditions exposed during construction with those that were observed during this investigation.

Site Preparation Grading and Compaction

- Areas of the site to be built on or paved should be stripped to remove any surface vegetation and organic topsoil. Soils containing more than 2% by weight of organic matter should be considered organic. Stripping depths should be determined in the field by the Soils Engineer at the time of stripping but, for planning purposes, an average stripping depth of 3 inches may be assumed. Strippings should be wasted off-site or, if so required by the Project Architect, stockpiled for subsequent use in landscape areas.

- Existing structures along with all utility lines including electric, water, sanitary sewers and storm drains designated for abandonment on the Project Plans, should be dug out and removed. All debris and materials arising from demolition and removal operations should be wasted off-site.

- Existing fill soils within areas of the site to be built on or paved should be sub-excavated. The depth and horizontal limits of these excavations should be determined in the field by the Soils Engineer at the time of excavation. For planning purposes, however, it may be assumed that these excavations will extend to an average depth of about 2 feet below existing ground surface. These excavations should extend 5 feet horizontally beyond proposed building lines and should extend 3 feet horizontally beyond edges of pavement.

- Soil surfaces exposed by excavations should be scarified to a depth of 10 inches, conditioned with water (or allowed to dry, as necessary) to produce a soil water content of at least 3 percent above the optimum value and then compacted to 90 percent relative compaction

based on ASTM Test D1557-91.

- Structural fill may then be placed up to design grades in the proposed building and pavement areas. Structural fill using on-site inorganic soil, or approved import, should be placed in layers, each not exceeding 8 inches thick (before compaction), conditioned with water (or allowed to dry, as necessary) to produce a soil water content of at least 3 percent above the optimum value, and then compacted to at least 90 percent relative compaction based of ASTM Test D1557-91. The upper 8 inches of pavement subgrades should be compacted to about 95 percent relative compaction based on ASTM Test D1557-91.

- On-site soils proposed for use as structural fill should be inorganic, free from deleterious materials, and should contain no more than 15% by weight of rocks larger than 3 inches (largest dimension) and no rocks larger than 6 inches. The suitability of existing soil for reuse as a structural fill should be determined by a member of our staff at the time of grading. We expect that most of the existing soil will be suitable for reuse as structural fill.

- If import is required for use as structural fill, it should be inorganic, should have a low expansion potential (with a plasticity index of 15 percent or less) and should be free from clods or rocks larger than 4 inches in largest dimension. Prior to delivery to the site, proposed import should be tested in our laboratory to verify its suitability for use as structural fills and, if found to be suitable, further tested to estimate the water content and density at which it should be placed.

Building Foundations

The proposed buildings may either be supported on conventional shallow foundations or on structural mat foundations bearing on competent in-place native soil or on compacted structural fill placed as described in the Site Preparation, Grading and Compaction section of the geotechnical investigation report.

Conventional Shallow Foundations

Continuous, reinforced concrete foundations may be designed to impose pressures on foundation soils up to 3000 pounds per square foot from dead plus normal live loading. Continuous foundations should be at least 12 inches wide and should be embedded at least 18 inches below rough pad grade or adjacent finished grade, whichever is lower.

Interior isolated foundations, such as may support column loads, may be designed to impose pressures on foundation soils up to 3750 pounds per square foot from dead plus normal live loading. Interior foundations should be embedded at least 18 inches below rough pad grade.

Based upon our experience with similar buildings constructed on similar foundation soils, we expect the total long-term static settlement of the building to be approximately 1(±) inch. Using the design values presented above, and assuming a minimum embeddment of both continuous and isolated footings, we would expect the post-construction differential settlement of a relatively uniformly loaded structure to be no more than about 3/4 of the total settlement.

Adjacent continuous foundation or isolated footings located adjacent to each other with various elevations should be designed so that the upper foundation is embedded at least 18 inches below and imaginary line that extends up from the bottom of a lower foundation at a slope of 1½ to 1 (horizontal to vertical) from the bottom of nearby building foundation.

Structural Mat Foundations

The proposed buildings may also be supported on reinforced concrete structural mat foundation bearing on native soils or on compacted structural fill. The structural mat should be designed by the project structural engineer; however, it should be at least 12 inches thick and reinforced with top and bottom, two-way steel reinforcements. The perimeter of the structural mat foundation should be embedded a minimum of 12 inches below the bottom of the slab.

For mat design, a coefficient of subgrade reaction of 120 kips per square foot per foot may be used. The structural mat foundation may be designed to impose pressure on foundation soils up to 2000 pounds per square foot from dead plus normal live load.

Lateral forces on the proposed building may de resisted by passive pressure acting against the sides of footings and by friction between the soil and the bottom of the footing. An equivalent fluid pressure of 300 pounds per square foot per foot of depth may be used to calculate the ultimate passive resistance to lateral loads. A coefficient of friction of 0.3 may be used to calculate resistance to lateral loads at the base of foundations.

In living areas, considering the thickness of the structural mat foundation and at the owners option, the section of capillary break material and the layer of protective sand, as described in the "Concrete Slab-on-Grade" section of the report, may be deleted provided that a 15 mil membrane such as "Stego Wrap 15-Mil" is used under the concrete mat slab.

General

The allowable foundation pressures given previously may be increased by one-third when considering additional short-term wind or seismic loading.

During foundation construction, care should be taken to minimize evaporation of water from foundation and floor subgrades. Scheduling the construction sequence to minimize the time interval between foundation excavation and concrete placement is important. Concrete should be placed only in foundation excavations that have been kept moist, are free from drying cracks and contain no loose or soft soil or debris.

Basement and Retaining Walls

The following may be used in the design calculations of any reinforced concrete retaining walls that may be needed.

1. The average bulk density of material placed on the backfill side of the wall will be 120 pcf.

2. The vertical plane extending down from the ground surface to the bottom of the heel of the wall will be subject to pressure that increases linearly with depth as follows.

Condition	Design Pressure
Active, level backfill (drained)	50 pcf
At-rest, level backfill (drained)	70 pcf

   The above values are non-seismic conditions. Active pressures should only be used for walls that are not restrained to move. At-rest pressures should be used for walls that are restrained from movement such as basement walls.

3. Considering the proximity of the site to active faults, retaining walls should be designed for seismic loading. The effects of earthquakes may be simulated by applying a horizontal line load surcharge to the stem of the wall at a rate of 18 H^2 lb/horizontal foot of wall, where H is the height of the surface of the backfill above the base of the wall. This surcharge should be applied at a height of 0.6H above the base of the wall.

4. A coefficient of "friction" of 0.3 may be used to calculate the ultimate resistance to sliding of the wall base over the ground beneath the base.

5. An equivalent fluid pressure of 350 psf/ft may be used to calculate the ultimate passive resistance to lateral movement of the ground in front of the toe of the wall.

6. Foundations for reinforced concrete retaining walls should be embedded at least 18 inches below rough pad grade or adjacent finished grade, whichever is lower.

7. A maximum allowable bearing pressure of 3000 psf may be used for the ground beneath the toe of the wall. This value is for non-seismic conditions and may be increased by one third when considering additional loads on the wall resulting from earthquakes.

A zone of drainage material at least 12 inches wide should be placed on the backfill side of walls designed for drained condition. This zone should extend up the back of the wall to about 18 inches down from the proposed ground surface above. The upper 18 inches or so of material above the drainage material should consist of clayey soil.

The drainage material and the clayey soil cap should be placed in layers about 6 inches thick and moderately compacted by hand-operated equipment to eliminate voids and to minimize post-construction settlement. Heavy compaction should not be applied; otherwise, the design pressure on the wall may be exceeded.

The drainage material should consist of either Class 2 Permeable Material complying with Section 68 of the CALTRANS Standard Specifications, latest edition, or 3/4 to 1½ inch clean, durable coarse aggregate. If the coarse aggregate is chosen as the drainage material, it should be separated from all adjacent soil by Mirafi 700X or a similar filter fabric approved by the project Soil Engineer.

Any water that may accumulate in the drainage material should be collected and discharged by a 4-inch-diameter, perforated pipe placed "holes don" near the bottom of the drainage material. The perforated pipe should have holes no larger that 1/4-inch diameter.

Concrete Slabs-On-Grade

Concrete floor slabs should be constructed on compacted soil subgrades prepared as described in the section on Site Preparation, Grading and Compaction.

If dampness of floors is not objectionable. concrete slabs may be constructed directly on the water-conditioned and compacted soil subgrade.

To minimize floor dampness, however, the following general guidelines may be used to minimize moisture-related problems in concrete floor slabs-on-grade that will be covered with moisture-sensitive floor coverings, adhesives, and coatings.

1. Install a section of capillary break material at least five inches thick. The capillary break should be a free-draining material, such as 3/8" pea gravel or a permeable aggregate complying with CALTRANS Standard Specifications, Section 68, Class 1, Type A or

Type B.

2. Cover the capillary break material with a high quality membrane vapor barrier. The membrane should be at least 10-mil thick.

3. To minimize the potential of accidental damage to the membrane vapor barrier and the potential of concrete slab curling, a protective cushion of sand or 3/8" pea gravel at least two inches thick should be placed between the membrane vapor barrier and the floor slab.

4. At the owner's option, the layer of protective sand mentioned above may be omitted provided that a 15 mil or thicker membrane vapor barrier (such as Stego Wrap) is used and that additional attention is given to the design of reinforcement so that potential curling stresses within the slab are addressed.

5. Consider using concrete having a low water/cement ratio to accelerate slab drying time. Use of fly ash may help reduce soluble alkali content in the slab. Water should not be added to the concrete after initial batching.

6. Water vapor emission levels and pH should be measured as required by the flooring material manufacturer prior to floor installation. Measurements and calculations should be performed in accordance with ASTM F1868-98 and F710-98.

The guidelines presented above are based on information obtained from various published sources including the American Concrete Institute (ACI) and Portland Cement Association (PCA). These guidelines are only intended to present information that can be utilized to minimize the potential of long term impact from slab moisture infiltration. The application of these procedures does not affect the geotechnical aspect of foundation performance.

Exterior Concrete Slab-on-Grade

Considering the potentially expansive nature of the surface layer of clay at this site, for flat work, exterior concrete slabs on grade (such as for patios and walks) should be at least 4 inches thick and should be cast over a minimum of 4 inches of class 2 aggregate base compacted to about 95 percent over compacted subgrade soils as described in the "Site Preparation, Grading and Compaction" section of our project geotechnical report. Exterior concrete slabs-on-grade should be reinforced with at least number 4 rebars spaced at 24 inches each way. If wire mesh reinforcements are used then they should be the flat panel welded wire mesh mats (not the rolled type) and should be 6x6 W4.7/4.7 (formerly called 6x6 – 3x3) cast in the center of the concrete section.

Portland Cement Concrete Pavement

For the garage concrete slab and for traffic areas, a concrete pavement section, where traffic includes occasional light trucks, should consist of at least 5 inches of Portland cement concrete pavement on top of at least 6 inches of Class 2 aggregate base material placed and compacted as described in the "Site Preparation, Grading and Compaction" section of the report. Prior to the placement and compaction of the class 2 aggregate base, it is important to water condition and compact the pavement subgrade soils as described in the "Site Preparation, Grading and Compaction" section of the report.

Concrete pavements should be reinforced with at least No. 4 reinforcing bars placed at 12 inches on-center in both directions.

For design of Portland Cement concrete pavement section, a modulus of subgrade reaction of k=130 pounds per square inch per inch should be used for the on-site compacted soils. Concrete for vehicle pavements should have a modulus of rupture of at least 550 pounds per square foot.

The garage concrete slab does not need to be underlain by a capillary break section as described in the section for "Concrete Slabs-on-Grade" of this report.

Vehicle Pavements

Near-surface soils across the site have a moderate pavement-supporting capacity. Considering the clayey nature of the pavement subgrade soils, an R-value of 10 at 300 psi exudation pressure was assumed in pavement design calculations. The actual R-value of the pavement soil subgrade should be tested and verified prior to construction.

Recommended minimum sections for pavement areas are presented in Table 1. A pavement section based on a Traffic Index of at least 5 should be selected for areas where traffic includes occasional light trucks.

TABLE 1 - RECOMMENDED MINIMUM ASPHALT CONCRETE PAVEMENT SECTIONS ON NATIVE SOILS			
Traffic Index (T.I.)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Total Thickness (inches)
4.5	3.0	8.0	11.0
5.0	3.0	9.0	12.0
5.5	3.5	10.0	13.5
6.0	4.0	11.0	15.0

Pavement subgrades should be compacted as described above in the section for Site Preparation Grading and Compaction.

Curbs and gutters should be constructed directly on the soil subgrade rather than on a layer of aggregate base. This will minimize the amount of surface water that seeps below the curb and into the pavement subgrade. The seepage of water into subgrade soils beneath vehicle pavements, can result in subgrade softening and premature pavement distress.

Pavement construction should comply with the requirements of the CALTRANS Standard Specifications, latest editions, except that compaction requirements for pavement soil subgrades and aggregate base should be based on ASTM Test D1557-91, as described in the part of this report dealing with "Site Preparation, Grading and Compaction."

Utility Trenches

The attention of contractors, particularly the underground contractor, should be drawn to the requirements of California Code of Regulations, Title 8, Construction Code Section 1540 regarding Safety Orders for "Excavations, Trenches, Earthwork".

For purposes of this section of the report, bedding is defined as material placed in a trench up to 1 foot above a utility pipe and backfill is all material placed in the trench above the bedding.

Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use in bedding should be tested in our laboratory to verify its suitability and to measure its compaction characteristics. Sand bedding should be compacted by mechanical means to achieve at least 90 percent compaction density based on ASTM Tests D1557-91.

Approved, on-site, inorganic soil, or imported material may be used as utility trench backfill. Proper compaction of trench backfill will be necessary under and adjacent to structural fill, building foundations, concrete slabs and vehicle pavements. In these areas, backfill should be conditioned with water (or allowed to dry) to produce a soil-water content of about 5 percent above the optimum value and placed in horizontal layers not exceeding 6 inches in thickness (before compaction). Each layer should be compacted to 87-90 percent relative compaction based of ASTM Test D1557-91. The upper 8 inches of pavement subgrades should be compacted to about 90 percent relative compaction based on ASTM Test D1557-91.

Where any trench crosses the perimeter foundation line of any building, the trench should be completely plugged and sealed with compacted clay soil for a horizontal distance of at least 2 feet on either side of the foundation. The bottom of utility trenches should be located above an imaginary line extending at a slope of 1½ to 1 (horizontal to vertical) from the bottom of nearby building foundation.

Soil Corrosivity

Three soil samples were obtained from the site at depths of about 4 feet below existing ground surface. These soil samples were delivered to Cooper Testing Laboratory to test for the potential for soil corrosivity. The laboratory test results of these samples are attached to this report.

Resistivity

Soil resistivity tests (ASTM G57) were performed on the soil samples. The resistivity of soil is a good general indicator of soil corrosivity since metal corrosion is an electrochemical reaction, i.e., the greater the current in a given corrosion cell, the higher the corrosion rate. Electrical resistivity is the inverse of electrical conductivity. Soil resistivity at this site was found to range from 643 to 785 Ohm-cm.

The NACE International classifications of corrosivity for steel in soils reported in the attached Corrosion Tests Summary Table, are as shown below:

Soil resistivity (ohm cm)	Corrosivity Rating
>20,000	Essentially non-corrosive
10,000 to 20,000	Mildly corrosive
5,000 to 10,000	Moderately corrosive
3,000 to 5,000	Corrosive
1,000 to 3,000	Highly corrosive
<1,000	Extremely corrosive

For the potential of steel corrosion, the NACE International soil corrosivity classification is based on average soil resistivity values for soils in general. Based upon the minimum resistivity of the three samples (643 ohm- cm), the soil would be classified as "extremely corrosive."

The evaluation of ductile iron and cast iron can be compared to the steel classification presented above. Considering the corrosion rates of iron and steel are very close, we generally compare the two classification systems. The two classification systems compare favorably and lead to the conclusion that soils represented by the samples tested are "highly corrosive" with respect to ductile and gray cast iron.

Chloride

Soil Chloride test (Cal 422-Mod) was performed on the soil samples and was found to be between 8 and 28 mg/kg. This chloride content is below threshold values for corrosion of steel.

Sulfate

Soil Water Soluble Sulfate test (Cal 417-Mod) was performed on the soil samples and was found to be less than 5 mg/kg and 18 mg/kg. This amount of water soluble sulfates is considered negligible.

Based on the results of the corrosion test performed on the soil samples, on site soils are considered potentially corrosive for steel and cast iron. Portland Cement Type II may be used for all concrete in contact with soil. Concrete steel reinforcement should have at least 3 inches cover for all concrete in contact with water.

Surface Drainage

Surface drainage gradients should be planned to prevent ponding and to promote drainage of surface water away from building foundations, slabs, edges of pavements and sidewalks, and towards suitable collection and discharge facilities.

Water seepage or the spread of extensive root systems into the soil subgrades of foundations, slabs, or pavements, could cause differential movements and consequent distress in these structural elements. This potential risk should be given due consideration in the design and construction of landscaping.

Drainage ditches and bio-swales should be located at least 5 feet away from building foundations, slabs, edges of pavements and sidewalks, and towards suitable collection and discharge facilities. Unpaved drainage swales and ditches should have a gradient of about 2 percent. If drainage swales and ditches are located less than 5 feet from pavements, then the curbs should be embedded at least 6

inches below pavement subgrade elevation.

If detention systems are used to collect and discharge surface water, they should be located at least 10 feet away from building foundations, slabs, edges of pavements and sidewalks. Furthermore, the bottom of the detention system should be located above an imaginary line extending at a slope of 1½ to 1 (horizontal to vertical) from the bottom of nearby building foundation.

Follow-up Geotechnical Services

Our recommendations are based on the assumption that **AMSO CONSULTING ENGINEERS** will be commissioned to perform the following services.

1. Almost half of the western portion of the site that is proposed for the construction of building one is currently occupied by BART parking and no soil samples were obtained from this location. We recommend that at least two exploration borings be drilled and soil samples obtained to confirm the assumed soil conditions for this area,

2. Review final grading and foundation plans prior to construction.

3. Observe and advise during clearing and stripping of the site.

4. Observe, test and advise during grading and placement of structural fill.

5. Test proposed capillary break material that will be used beneath concrete slabs-on-grade and advise on suitability.

6. Observe and advise during foundation and slab construction.

7. Observe, test and advise during utility trench backfilling.

8. Observe, test and advise during construction of pavements.

LIMITATIONS

The recommendations contained in this report are based on certain plans, information and data that have been provided to us. Any change in those plans, information and data will render our recommendations invalid unless we are commissioned to review the change and to make any necessary modifications and/or additions to our recommendations.

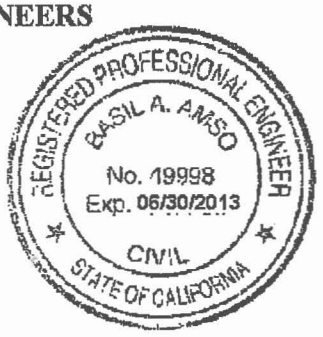
Subsurface exploration of any site is necessarily confined to selected locations. Conditions may, and often do, vary between and around such locations. Should conditions different from those encountered in our explorations come to light during project development, additional exploration, testing and analysis may be necessary; changes in project design and construction may also be necessary.

Our recommendations have been made in accordance with the principles and practices generally employed by the geotechnical engineering profession. This is in lieu of all other warranties, express or implied.

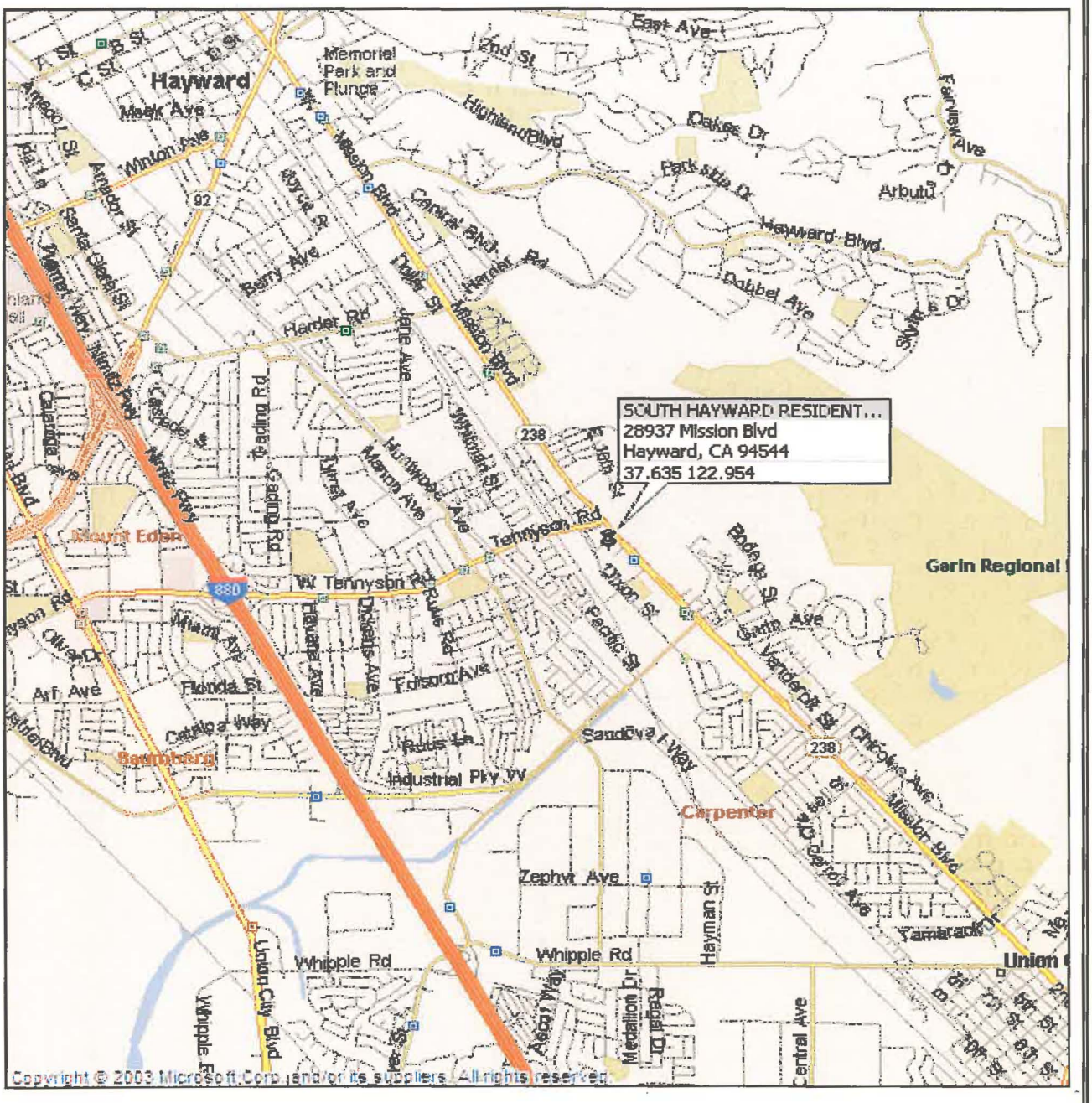
All earthwork and associated construction should be observed by our field representative, and tested where necessary, to compare the generalized site conditions assumed in this report with those found at the site at the time of construction, and to verify that construction complies with the intent of our recommendations.

Report prepared by:

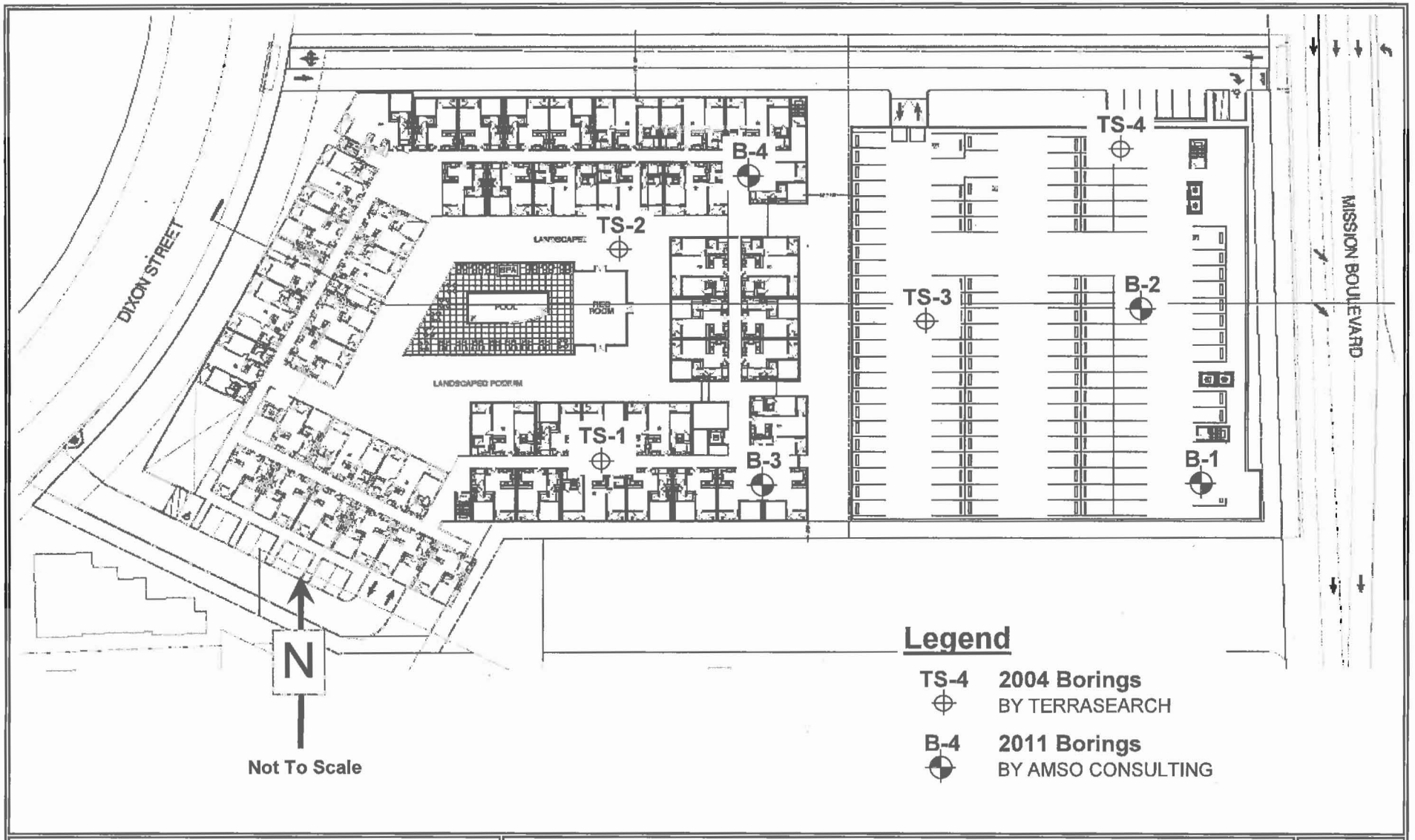
AMSO CONSULTING ENGINEERS



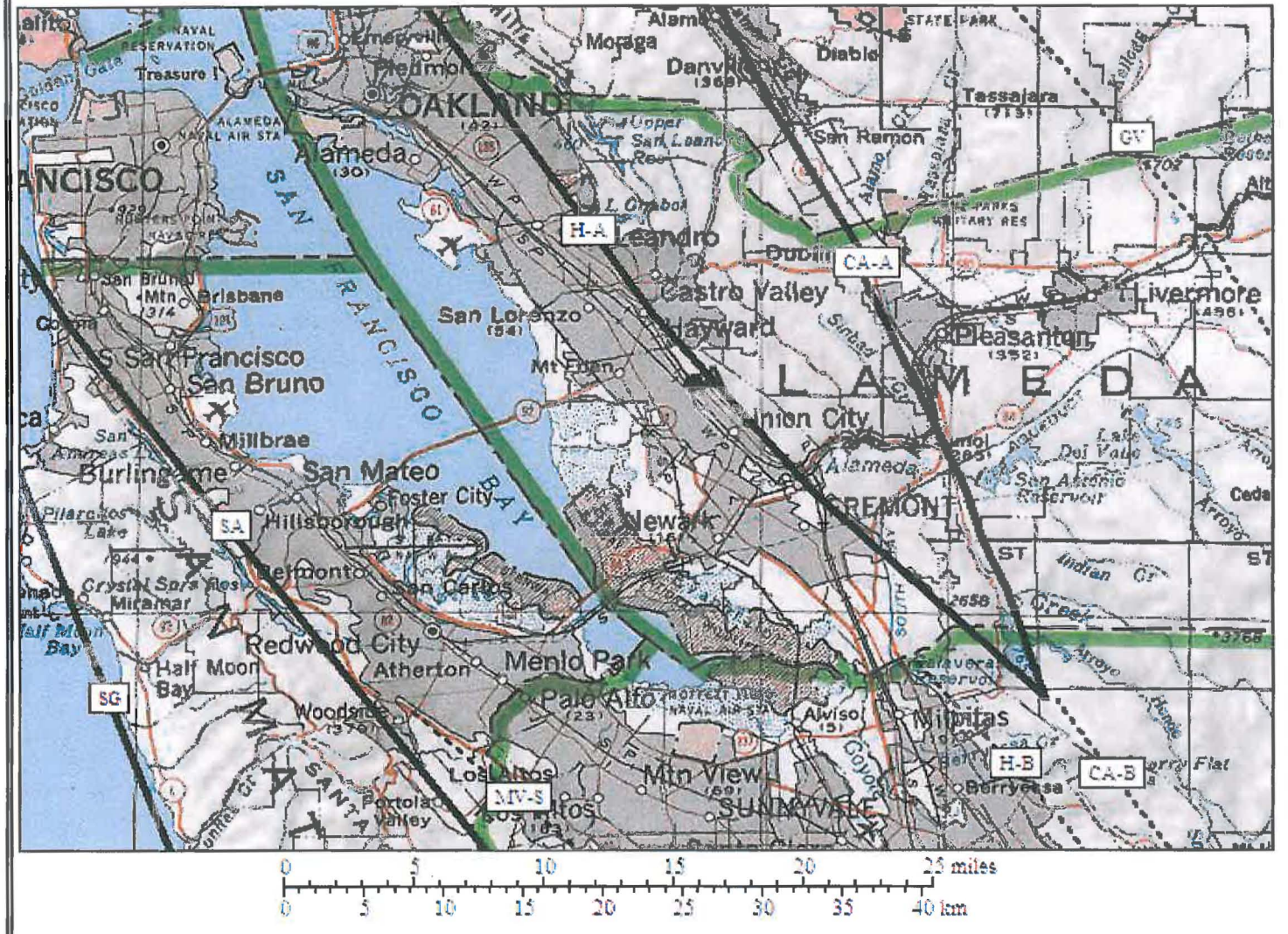
Basil A. Amso
CE 49998



AMSO CONSULTING ENGINEERS	**VICINITY MAP**	**FIGURE 1**
SEPTEMBER 2011	**SOUTH HAYWARD RESIDENTIAL PROJECT 28937 MISSION BOULEVARD HAYWARD, CALIFORNIA**	**PROJECT 3567**



AMSO CONSULTING ENGINEERS	SITE PLAN AND APRIXIMATE LOCATION OF EXPLORATION HOLES	FIGURE 1
SEPTEMBER 2011	SOUTH HAYWARD RESIDENTIAL PROJECT 28937 MISSION BOULEVARD HAYWARD, CALIFORNIA	PROJECT 3567



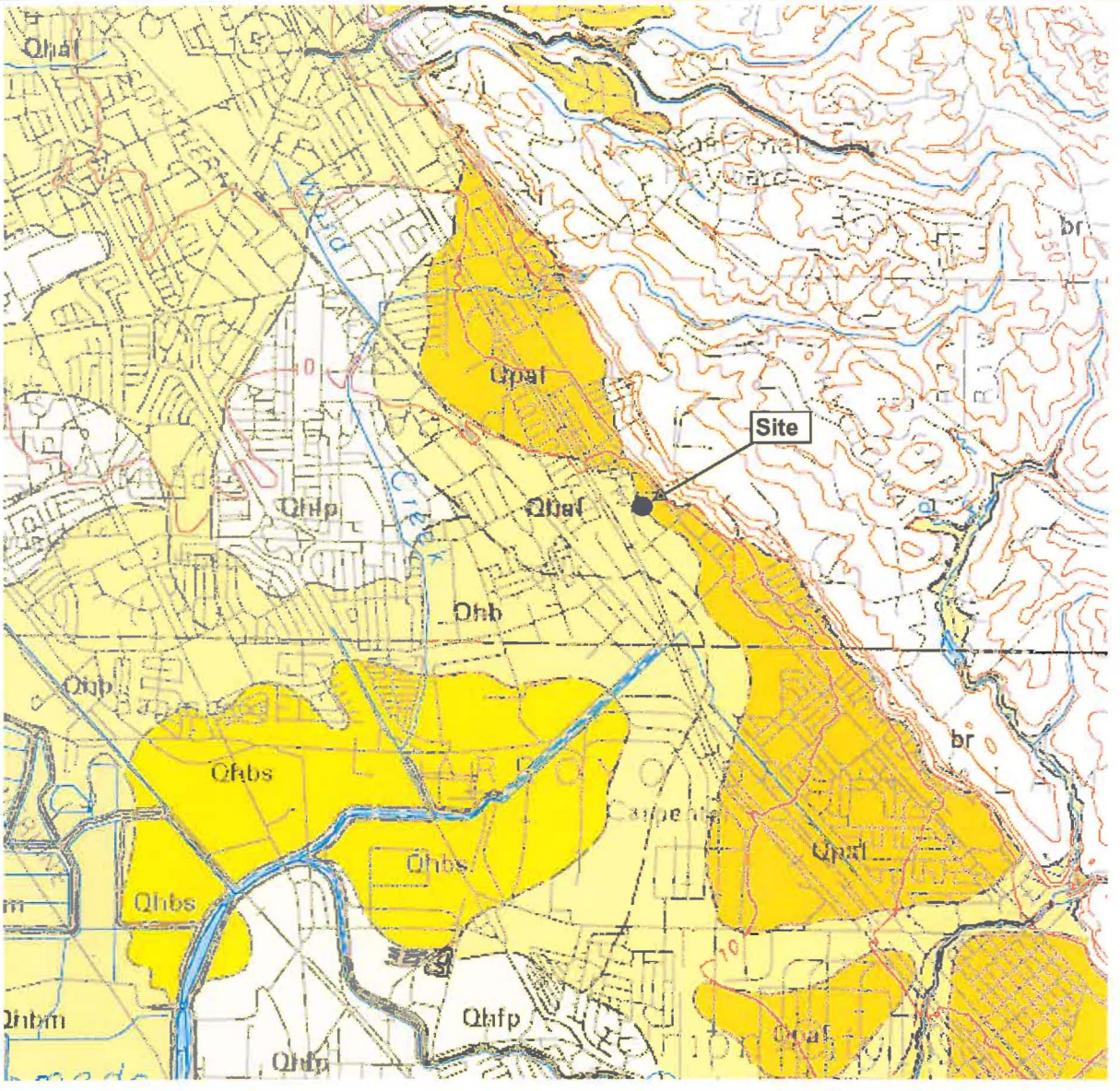
LEGEND

———	Type "A" Faults
SA	San Andreas
SG	San Gregorio
HA	Hayward
CA	Calaveras
·····	Type "B" Faults
GV	Greenville
CA-B	Calaveras (So. Of Reser)
H-B	Hayward - SE Ext.
MV-S	Monte Vista - Shannon
SAR	Sargent
ZA-VER	Zayante - Vergeles

● Site Location

This map should not be used to determine whether or not a given property lies on a fault line. Its only purpose is to give the reader of this report a feel of aprox. distances to Types A & B fault.
Faults other than Types A & B are not shown on this map.

AMSO CONSULTING ENGINEERS	APPROXIMATE LOCATION OF FAULTS	FIGURE 3
SEPTEMBER 2011	SOUTH HAYWARD RESIDENTIAL PROJECT 28937 MISSION BOULEVARD HAYWARD, CALIFORNIA	PROJECT 3567



MAP SOURCE: Quarternary Geology of Alameda County and Surrounding Areas, California Derived from the Digital Database Open-File 97-97, By E.J. Helley and R.W. Graymer, 1997

LEGEND

Qhaf	Alluvial Fan and Fluvial Deposits (Holocene)
Qpaf	Alluvial Fan and Fluvial Deposits (Pleistocene)

AMSO CONSULTING ENGINEERS	**GEOLOGIC MAP**	**FIGURE 4**
SEPTEMBER 2011	**SOUTH HAYWARD RESIDENTIAL PROJECT 28937 MISSION BOULEVARD HAYWARD, CALIFORNIA**	**PROJECT 3567**

APPENDIX A

Key to Exploration Logs and Boring Logs

KEY TO EXPLORATORY BORING LOGS

SOIL CLASSIFICATIONS

PRIMARY DIVISIONS			GROUP1 SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size	GRAVELS More than half coarse fraction is larger than No.4 sieve	Clean Gravels (less than5% fines*)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravel with fines*	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS More than half coarse fraction is smaller than No.4 sieve	Clean Sands (less than 5%fines*)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		Sands with fines*	SM	Silty sands, silt-sand mixtures, non-plastic fines
			SC	Clayey sand, sand-clay mixtures, plastic fines
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size	SILTS AND CLAYS Liquid limit is less than 35		ML	Inorganic silts, clayey silts, rock flour, silty very fine sands
			CL	Inorganic clays of low plasticity, gravelly clay of low plasticity
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit is between35 and 50		MI	Inorganic silts, clayey silts and silty fine sand with intermediate plasticity
			CI	Inorganic clays, gravely clays, sandy clays and silty clays of intermediate plasticity
			OI	Inorganic clays and silty clays of intermediate plasticity
	SILTS AND CLAYS Liquid limit is greater than 50		MH	Inorganic silts, clayey silts, elastic silts, micaceous or diatomaceous silty or fine sandy soil
			CH	Inorganic clays of high plasticity
			OH	Organic clays and silts of high plasticity
HIGHLY ORGANIC SOILS			Pt	Peat, meadow mat, highly organic soils

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS			
200	40	10	4	¾"	3"	12"	
Silts and Clays	Fine	Medium	Coarse	Fine	Coarse	Cobbles	Boulders
	SAND			GRAVEL			

RELATIVE DENSITY

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT*
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	30 – 50
VERY DENSE	OVER 50

CONSISTENCY

CLAYS AND PLASTIC SILTS	UNCONFINED SHEAR STRENGTH (PSF)	BLOWS/FOOT*
VERY SOFT	0 – 250	0 – 2
SOFT	250-500	2 – 4
FIRM	500-1000	4 – 8
STIFF	1000-2000	8 – 16
VERY STIFF	2 000– 4000	16 – 32
HARD	>4000	OVER 32

SYMBOLS

▽	Initial Ground Water Level
▼	Final Ground Water Level
*	Standard Penetration Sampler
x	Modified California Sampler
D	Dames & Moore Sampler

NOTES

*BLOWS per FOOT – Resistance to advance the soil sampler in number of blows of a 140-pound hammer falling 30 inches to drive a split spoon sampler.

Stratification lines on the logs represent the approximate boundary between soil types, and the transition may be gradual.

Modified California Sampler – 2 ½ O.D. (1 7/8 Inch I.D.) sampler

Standard Penetration Sampler – 2 inch O.D. (1 3/8 Inch I.D.) split spoon sampler (ASTM D1586).

Dames & Moore Sampler – 3 inch O.D. (2.5 inch I.D.) sampler

BORING LOG

No. B-1

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL 29 ft | FINAL 26 ft | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Asphalt Concrete over Base rock												
Silty Clay; grayish brown, damp, stiff	CL/ CH	1										
		2										
		3										
			x									
		4	x	22	2.5			24		92	10	5585
Silty Clay; light orange brown, dry, stiff	CL	5										
		6										
		7										
		8										
slightly sandy		9										
			x				48		20			
		10	x	25	3.5			17		104	6	4610
		11										
		12										
		13										
		14										
orange brown		15	x	19	4.1			21		104	8	5420
		16										
		17										
		18										
		19										
		20	x	35	3.5			23		97	8	7440

BORING LOG

No. B-1

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL 29 ft | FINAL 26 ft | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Silty Sandy Clay; light orange brown, dry, very stiff to hard	CL											
		21										
		22										
		23										
		24										
gravelly, moist		25	x	29	3.0			29		93	9	3920
		26				▼						
		27										
		28										
		29				▽						
gravelly, moist		30	*	47	4.0							
		31										
		32										
		33										
		34										
		35	*	32	4.2							
		36										
		37										
		38										
		39										
Bottom of hole at 40 feet		40	*	48	>4.5							

BORING LOG

No. B-2

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL --- | FINAL --- | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Asphalt Concrete over Base rock												
Very Sandy Silty Clay; brown to gray, damp, medium stiff; Fill	CH	1										
		2	x	10	1.1			10		93		
		3										
Silty Clay; dark gray, damp, stiff	CH		x									
		4	x	30	2.1			26		95	8	6880
		5										
		6										
		7										
Silty Sandy Clay; brown to light brown, damp, stiff	CL	8										
		9										
			x									
		10	x	30	4.1			19		102	9	7310
		11										
		12										
		13										
		14										
		15	x	36	4.5			19		101	9	5250
		16										
		17										
		18										
		19										
		20	*	32	3.5							

BORING LOG

No. B-2

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL --- | FINAL --- | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Very Sandy Silty Clay; light brown to orange brown, damp, very stiff to hard	CL	21										
		22										
		23										
		24										
		25	*	32	3.8							
Bottom of hole at 25 feet No ground water encountered		26										
		27										
		28										
		29										
		30										
		31										
		32										
		33										
		34										
		35										
		36										
		37										
		38										
		39										
		40										

BORING LOG

No. B-3

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL 16.5 ft | FINAL 14.5 ft | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Sandy Silty Clay; light brown, damp, medium stiff; fill	CL	1										
		2	x	9	1.1			10		91		
Silty Clay; dark gray and brown, damp, stiff	CH	3										
		4	x	22	2.2			28		90	8	4290
		5										
		6										
Sandy Silty Clay; light brown, damp, stiff	CL	7										
		8										
		9										
			x				48		21			
very silty with fine sand		10	x	24	3.2			29		87	10	3855
		11										
		12										
		13										
		14										
with angular gravels, wet		15	x	25	2.1			28		91	9	3100
		16										
		17										
		18										
		19										
Bottom of hole at 20 feet		20	x	32	3.5			20		105	8	7680

BORING LOG

No. B-4

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL 14.5 ft | FINAL 12 ft | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Silty Clay; light brown and gray, damp, medium stiff; fill	CL	1										
		2	x	6	0.8			10		93		
Silty Clay; dark gray and brown, dry stiff	CH	3										
			x				51		19			
sandy		4	x	16	1.8			26		85	6	1865
		5										
		6										
Sandy Silty Clay; light brown, damp, stiff to very stiff	CL	7										
		8										
		9										
more sandy, moist		10	x	18	3.2			22		103	9	4305
		11										
		12				▽						
Silty and Gravelly Sand; gray, wet, medium dense	SM/ SP	13										
		14				▽						
Sandy Silty Clay; light orange brown, moist, stiff	CL	15	x	23	3			20		107		
		16										
		17										
		18										
		19										
very silty		20	*	27	3.2							

BORING LOG

No. B-4

PROJECT South Hayward Residential Buildings | DATE 09/08/2100 | LOGGED BY BAA

DRILL RIG Continuous Flight, Solid Auger | HOLE DIA. 4" | SAMPLER X - Modified California; * - S.P.T

GROUND WATER DEPTH INITIAL 14.5 ft | FINAL 12 ft | HOLE ELEVATION

DESCRIPTION	SOIL TYPE	DEPTH	SAMPLE	BLOWS PER FOOT	POCKET PEN (tsf)	TORVANE (tsf)	LIQUID LIMIT (%)	WATER CONTENT (%)	PLASTIC LIMIT (%)	DRY DENSITY (pcf)	FAILURE STRAIN (%)	UNCONFINED COMPRESSIVE STRENGTH (psf)
Very sandy Clay to Clayey Silt; brown, damp, stiff	CL/ ML	21										
		22										
		23										
		24										
		25	*	16	2							
		26										
Silty Sandy Clay; light brown, moist, very stiff to hard	CL	27										
		28										
		29										
		30	*	33	3							
		31										
		32										
		33										
		34										
		35	*	32	3.8							
		36										
		37										
		38										
		39										
Bottom of hole at 40 feet		40	*	31	4.1							

DEPTH (feet)	SAMPLE NO.	SAMPLE	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	COMMENTS
				1" AC, 8" AB at surface, dry. Sandy silty CLAY (CL) with gravels, light brown, dry.	CL				
1				Silty CLAY (CH) with occasional fine gravels, dark grey to black, stiff, damp, high plasticity, with trace of reddish brown ferrous oxide.	CH				
	B1-2					18		25	% - #200 = 84% LL = 67% PI = 43
5									
	B1-5			Sandy CLAY (CL), light brown to brown, hard, moist, medium plasticity.	CL	36			
					CL				
10				Silty CLAY (CL) with trace of coarse sand, brown, stiff, moist, low to medium plasticity.					
	B1-10					12			
					CL				
15				Sandy CLAY (CL) with trace of coarse sand and fine gravel, brown, very stiff, wet, low plasticity.					
	B1-15					27			
				Medium stiff to soft @ 18'.	CL				
20				Silty CLAY (CL) with trace of coarse sand and fine gravel, light brown, stiff to very stiff, damp, low plasticity, (Becomes dark grey to black @ 21 1/4').					
	B1-20					15			
				Boring terminated @ 21 1/4' below ground surface (BGS). Groundwater encountered @ 15 1/2' (BGS).					
25									
30									
35									

Logged by:	Date Drilled:	Diameter:	Drill Rig:
K.L.	5/20/04	6"	Solid Auger

EXPLORATORY BORING LOG B-1

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH INC.
257 WRIGHT BROTHERS AVENUE LIVERMORE CALIFORNIA 94550 PHONE (925) 243-0662

MISSION & TENNYSON
HAYWARD, CALIFORNIA

Figure No. 2

Project No.	Drafted by:	Scale:	Date:	Sheet:
10255.G	E.PACREM	1" = 5'	05/2004	1 of 1

DEPTH (feet)	SAMPLE NO.	SAMPLE	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	COMMENTS
				1" AC, 8" AB @ surface dry. Sandy silty CLAY with gravel, light brown, dry.					
1				Silty CLAY (CH), dark grey to black, very stiff, damp, high plasticity.	CH				
	B2-2					18	92	27	qu = 4080 psf.
5									
	B2-5			Silty CLAY (CL), light brown to brown, very stiff, damp, low plasticity.	CL	22			
10				Clayey SILT (ML), light brown, stiff, moist, low plasticity.	ML				
	B2-10					10			
				Soft @ 13' - 14'.					
15				Sandy CLAY (CL) with trace of coarse sand and fine gravel, brown, very stiff to hard, moist, low plasticity.	CL				
	B2-15					32			
					CL				
20				Silty CLAY (CL), brown, very stiff, moist, low to medium plasticity.					
	B2-20					22			
25				Silty CLAY (CL) with trace of coarse sand, brown, medium stiff to stiff, moist, medium plasticity.					
	B2-25					9			
				Boring terminated @ 26½' below ground surface (BGS). Groundwater encountered @ 16' (BGS).					
30									
35									

Logged by:	Date Drilled:	Diameter:	Drill Rig:
K.L.	5/20/04	6"	Solid Auger

EXPLORATORY BORING LOG B-2

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH INC.
257 WRIGHT BROTHERS AVENUE LIVERMORE CALIFORNIA 94550 PHONE (925) 243-6662

MISSION & TENNYSON
HAYWARD, CALIFORNIA

Figure No. 3

Project No.	Drafted by:	Scale:	Date:	Sheet:
10255.G	E.PACREM	1" = 5'	05/2004	1 of 1

DEPTH (feet)	SAMPLE NO.	SAMPLE	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	COMMENTS
				6" AB at surface, sand and gravel, dry.					
1				FILL; Silty CLAY (CL), dark grey to black, stiff, damp, low to medium plasticity.	CL				
					GW-GM				
5	B3-5			Well graded GRAVEL with silt and sand (GW-GM), brown, medium dense, fine grained.		18	121	9	
					CH				
10	B3-10			Silty CLAY (CH) with occasional coarse sand, dark grey to black, very stiff to hard, damp, high plasticity.		30		24	% - #200 = 81% LL = 67% PI = 44
					CL				
15	B3-15			Silty CLAY (CL) with occasional coarse sand, brown, very stiff, damp, low plasticity.		24			
20	B3-20			Very sandy with trace of coarse gravel and reddish brown ferrous oxide fragments.		12		34	Sieve analysis
				Silty SAND (SM) with fine grained gravel, brown, loose to medium dense, damp to moist, fine and poorly graded.	SM				
					CL				
25	B3-25			Silty CLAY (CL) with trace of coarse sand, brown, very stiff, damp to moist, low to medium plasticity.		27			
					CL				
30	B3-30			Sandy CLAY (CL), brown, very stiff, wet, low plasticity.		27			
35	B3-35			Sandy silty CLAY (CL) with trace of coarse sand and occasional fine gravel, brown, hard, damp, low plasticity.					
				Boring terminated @ 36½' below ground surface (BGS). GW encountered @ 28' (BGS).					

Logged by:	Date Drilled:	Diameter:	Drill Rig:
K.L.	5/20/04	6"	Solid Auger

EXPLORATORY BORING LOG B-3

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH INC.
267 WRIGHT BROTHERS AVENUE LIVERMORE CALIFORNIA 94550 PHONE: (925) 243-6562

MISSION & TENNYSON
HAYWARD, CALIFORNIA

Figure No. 4

Project No.	Drafted by:	Scale:	Date:	Sheet:
10255.G	E.PACREM	1" = 5'	05/2004	1 of 1

DEPTH (feet)	SAMPLE NO.	SAMPLE	GRAPHIC LOG	SOIL DESCRIPTION	SOIL CLASSIFICATION	CONVERTED SPT BLOW COUNT (BLOWS/FT.)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	COMMENTS
				1" AC, 8" AB at surface, dry.					
1				FILL: Silty CLAY (CL), dark grey, damp.	CL				
					SW-SM				
5	B4-5			Well graded SAND with silt and gravel (SW-SM), brown, dense, fine grained, (becomes dark grey to black @ 6½').		31		76	% - #200 = 16%
					CH				
10	B4-10			Silty CLAY (CH) with trace of coarse sand & fine gravel, greyish brown to dark brown, very stiff to hard, damp, high plasticity, with greenish & occasional white (crystal) rock fragments (~¼").		31			
					CL				
15	B4-15			Silty CLAY (CL) with occasional coarse sand, brown to greenish brown, very stiff, damp, low plasticity.		25			
20	B4-20					25			
25				Becomes brown.					
30	B4-30			Silty CLAY (CL) with trace of coarse sand & gravel, brown, very stiff, damp to moist, low plasticity.		18			
				Boring terminated @ 31½' below ground surface (BGS). Groundwater encountered @ 30' (BGS).					
35									

Logged by:	Date Drilled:	Diameter:	Drill Rig:
K.L.	5/20/04	6"	Solid Auger

EXPLORATORY BORING LOG B-4

GEOTECHNICAL ENGINEERS AND GEOLOGISTS
TERRASEARCH INC.
257 WRIGHT BROTHERS AVENUE LIVERMORE CALIFORNIA 94550 PHONE: (925) 243-9562

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HAYWARD, CALIFORNIA

Figure No. 5

Project No.	Drafted by:	Scale:	Date:	Sheet:
10255.G	E.PACREM	1" = 5'	05/2004	1 of 1

APPENDIX B

Laboratory Test Results

PLASTICITY INDEX

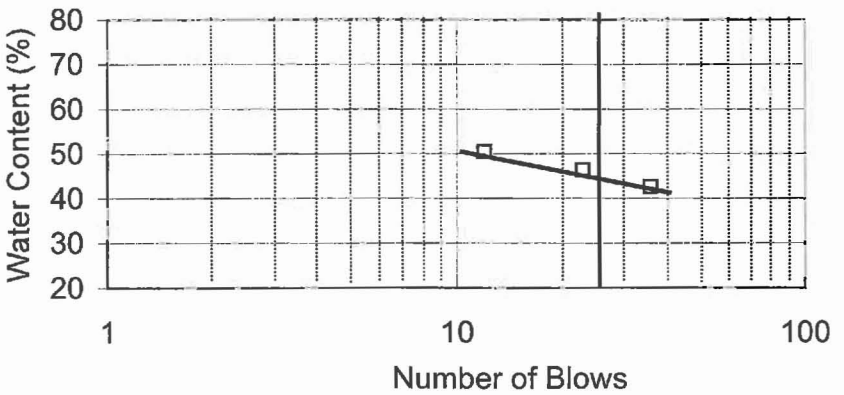
TEST DESIGNATION: ASTM D4318 OR CAL 204

Project Name:	South Hayward Housing	Project No.:	3567
Sample No.:	B1 - 9 ft	Lab No.:	
Location		Test Date:	09/10/2011
Description:	Silty Clay	Tested By:	TOSCANO TESTING

TEST DATA

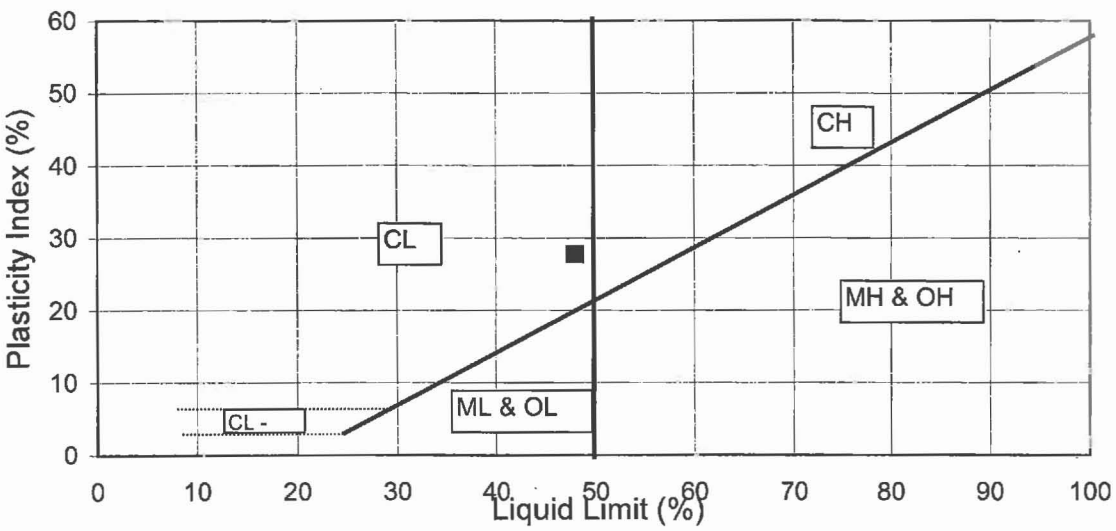
	Liquid Limit				Plastic limit			Water Content
Number of Blows	12	23	36					
Tare Number	24	30	21		D			
Tare + Wet Wt (gm)	46.49	43.30	43.02		47.98			
Tare + Dry Wt (gm)	36.09	34.62	34.61		42.54			
Tare Wt (gm)	15.50	15.92	14.92		15.67			
Wt of Water (gm)	10.40	8.68	8.41		5.44			
Soil Dry Wt (gm)	20.59	18.70	19.69		26.87			
Water Content (%)	50.51	46.42	42.71		20.25			
			Average		20.25			

Liquid Limit Test



LL	PL	PI
48	20	28

Plasticity Chart



PLASTICITY INDEX

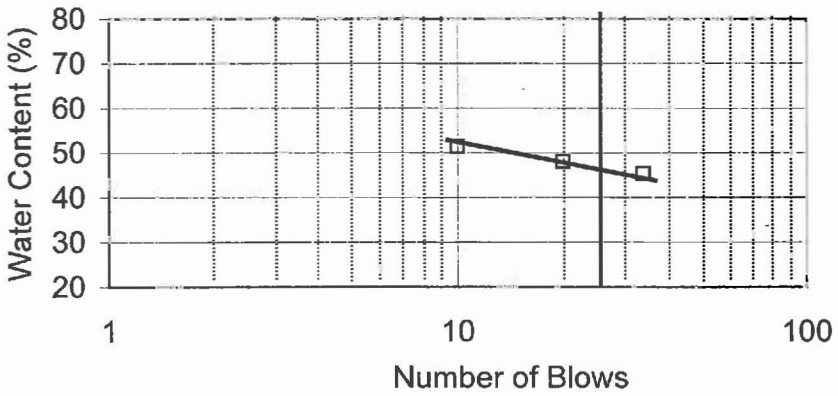
TEST DESIGNATION: ASTM D4318 OR CAL 204

Project Name:	South Hayward Housing	Project No.:	3567
Sample No.:	B3 - 9 ft	Lab No.:	
Location		Test Date:	09/10/2011
Description:	Silty Clay	Tested By:	TOSCANO TESTING

TEST DATA

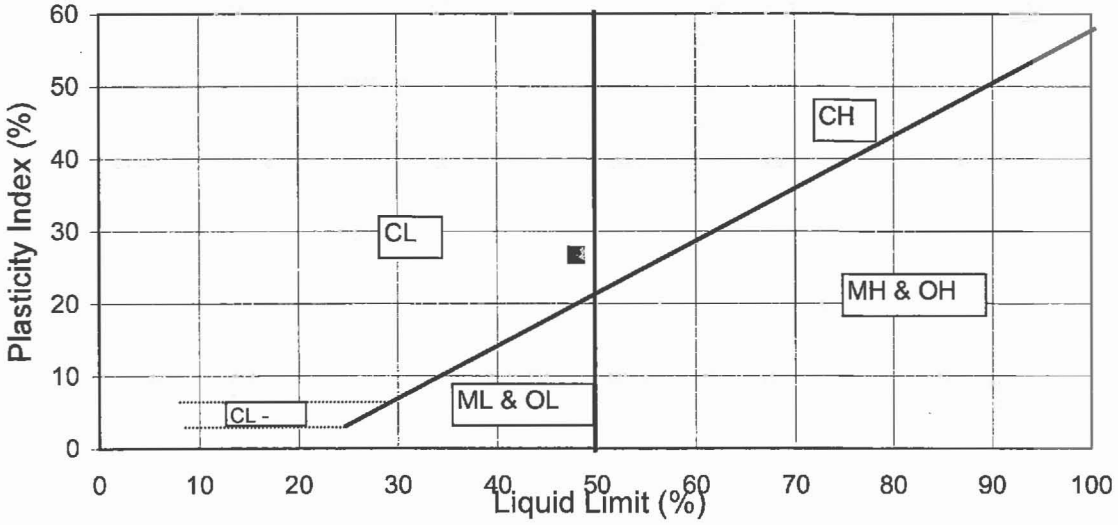
	Liquid Limit				Plastic limit			Water Content
Number of Blows	10	20	34					
Tare Number	A	21	34		12			
Tare + Wet Wt (gm)	46.61	43.83	43.20		46.21			
Tare + Dry Wt (gm)	36.10	34.73	34.59		40.92			
Tare Wt (gm)	15.67	15.81	15.62		16.05			
Wt of Water (gm)	10.51	9.10	8.61		5.29			
Soil Dry Wt (gm)	20.43	18.92	18.97		24.87			
Water Content (%)	51.44	48.10	45.39		21.27			
			Average		21.27			

Liquid Limit Test



LL	PL	PI
48	21	27

Plasticity Chart



PLASTICITY INDEX

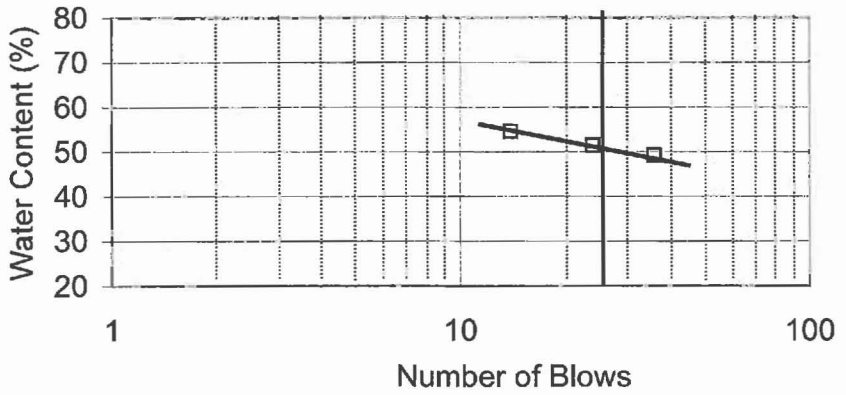
TEST DESIGNATION: ASTM D4318 OR CAL 204

Project Name:	South Hayward Housing	Project No.:	3567
Sample No.:	B4 - 3.5	Lab No.:	
Location		Test Date:	09/10/2011
Description:	Silty Clay	Tested By:	TOSCANO TESTING

TEST DATA

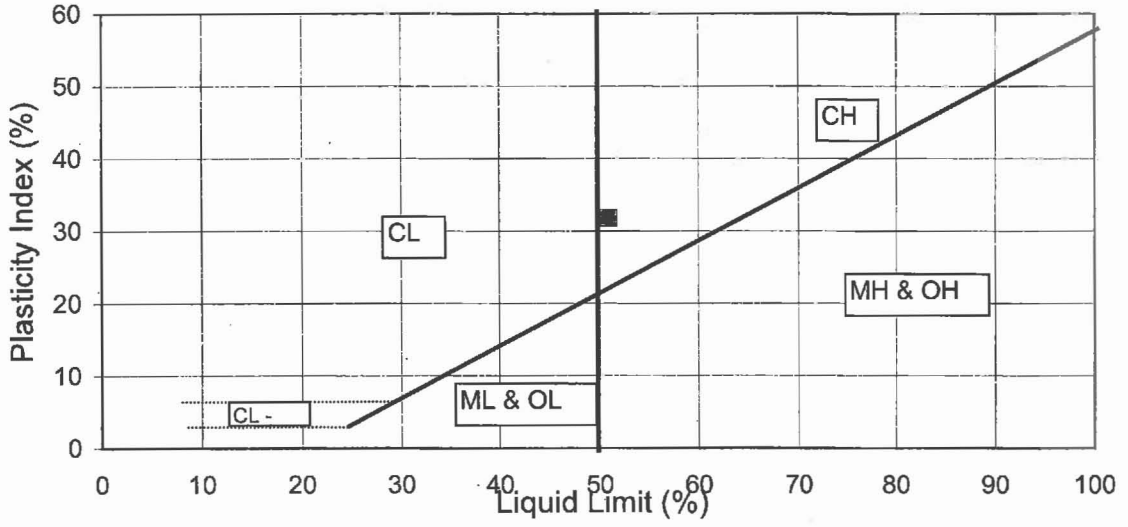
	Liquid Limit				Plastic limit			Water Content
Number of Blows	14	24	36					
Tare Number	3	11	32		6			
Tare + Wet Wt (gm)	43.50	46.65	42.40		45.50			
Tare + Dry Wt (gm)	33.82	37.32	34.45		40.67			
Tare Wt (gm)	16.10	19.21	18.32		15.52			
Wt of Water (gm)	9.68	9.33	7.95		4.83			
Soil Dry Wt (gm)	17.72	18.11	16.13		25.15			
Water Content (%)	54.63	51.52	49.29		19.20			
			Average		19.20			

Liquid Limit Test



LL	PL	PI
51	19	32

Plasticity Chart



Corrosivity Test Summary

CTL # 547-028 Date: 9/19/2011 Tested By: PJ Checked: PJ

Client: Amso Consulting Eng. Project: South Hayward Proj. No: 3567

Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate-(water soluble)		pH	ORP	Sulfide	Moisture	Soil Visual Description
Boring	Sample, No.	Depth, ft.	As Rec.	Minimum	Saturated	mg/kg	mg/kg	%		(Redox)	Qualitative	%	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	by Lead	At Test	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	ASTM G51	SM 2580B	Acetate Paper	ASTM D2216	
B1	-	4.5	-	-	785	8	<5	<0.0005	7.4	-	-	22.2	Black CLAY
B4	-	4.5	-	-	643	28	18	0.0018	7.4	-	-	26.5	Black CLAY